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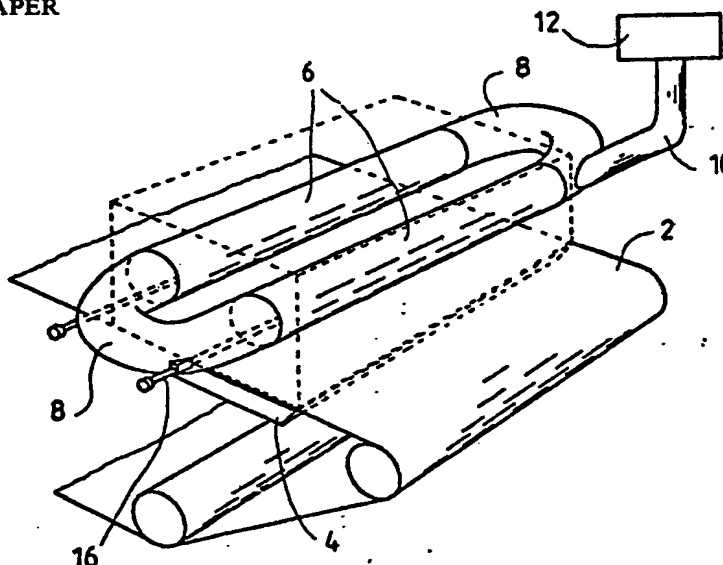
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(54) Title: **A DISTRIBUTOR UNIT FOR DRY LAYING OUT OF FIBRES, PREFERABLY FOR DRY MANUFACTURING OF PAPER**



(57) Abstract

A distributor unit for dry laying out of fibres on a forming wire which comprises a perforated pipe (6) which from one end is supplied with an air fluidized fibre material which is discharged through the perforations in the preferably rotating pipe (6). According to the invention the pipe (6) is made of corrugated sheet material, the undulations extending in the longitudinal direction of the pipe and thus contributing substantially to the pipe's being self-supporting over a large length. Moreover, the pipe (6) will hereby show an increased surface area for a given diameter, and therewith an increased number of perforations and a correspondingly increased discharge capacity at a given degree of perforation. The undulated cross sectional shape of the pipe wall provides special advantages, when a rotating needle cylinder (16, 18), stationary mounted inside the pipe, is used for further increased of the discharge capacity.

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A distributor unit for dry laying out of fibres, preferably for dry manufacturing of paper.

The present invention relates to a distributor unit for dry laying out of fibres on a forming wire, preferably for dry manufacturing of paper, and of the type which comprises one or more perforated pipes, 5 which extend over the forming wire and is connected to supply means for an air fluidized fibre material. Such a unit has been described in the European Patent Specification No. 0032772.

In known units of this type the perforated pipe, 10 which is preferably kept in rotation, is designed as a shell of perforated sheet material, having a large number of perforations, so that the pipe functions as a classification screen with a good discharge capacity for the fibres. These are supplied to the pipe at one end 15 thereof and brought to flow through the pipe in a relatively strong fibre-air flow, which is recirculated through a corresponding pipe placed next to and parallel with the first pipe, so that the flow circulates through the two pipes. Underneath the 20 forming wire is placed a suction box creating a downwardly directed flow of air which sweeps across the outside of the perforated pipes and partly flows through the perforated pipes transversely to these whereby fibres will be led out through the perforations 25 all along the pipes, and the discharged fibres are conveyed with the suction air for depositing on the forming wire.

Inside the pipes may be placed means such as prezzurized air nozzles or a rotating needle cylinder 30 which can influence the fibre/air stream in different manners, namely for agitation of the flow for maintaining the air suspension of the fibres, for imparting to the flow a force component directed outwardly towards the screen wall, whereby the

discharge capacity of the fibres may be substantially increased, and/or for influencing the flow in the axial moving direction thereof, namely for supporting the flow itself through the pipe.

5 During the operation the circulating fibre/air flow is supplied with as much fibre material as is being discharged through the perforated pipes, and it is hereby advantageous that an even fibre distribution on the forming web can be obtained despite possible  
10 variations in the flow of supplied fibre material, just as a reasonably good discharge capacity of the fibres may be achievable.

The discharge capacity has a very great importance; i.e. it is desirable to have a large  
15 number of perforations in the said pipes. However, the pipes should preferably be self-supporting between their opposite ends, as the use of special support members along the pipes may have a disturbing effect on the desired evenness of the fibre layer laid  
20 out on the forming wire, and when the pipes should thus be quite rigid, there is a limit to the degree of perforation they may have in practice. Naturally, the number of perforations may be increased by an increase of the pipe diameter, but here, as well, there are  
25 practical limitations for such an increase.

According to the invention an increased number of perforations is provided in a manner proving extremely advantageous in several respects in the given context.

30 According to the invention the perforated pipe is constituted by a sheet or a cylinder consisting of a corrugated sheet material, having its undulations extending in the longitudinal direction of the pipe. At a given pipe diameter and degree of perforation  
35 the total pipe wall area and herewith also the number of perforations will thus be increased.

Moreover, the undulated cross sectional shape

will to a very high degree stabilize the pipe against downward bending, whereby it may even be achievable to make use of an increased degree of perforation, as well as an increased pipe length.

5        With the use of a rotating needle or carding cylinder placed stationarily in the pipe, further advantages are obtained, which are explained in more detail below.

In the following the invention is described in  
10 more detail with reference to the drawing, in which

Fig. 1 is a schematic perspective view of a system for dry forming of paper,

Fig. 2 is a perspective view of a part of a distributor pipe used therein, designed according  
15 to the invention,

Fig. 3 is a cross sectional view of the same pipe and

Fig. 4 is a detailed partial view of the same cross sectional view.

20        The system shown in Fig. 1 is described in more detail in the European Patent Specification No. 32772. It consists of a moved forming wire 2, underneath which is placed a suction box 4, and above which is placed a distributor unit 6 consisting of two parallel  
25 perforated pipes 6, which at their respective opposite ends are connected through non-perforated pipe bends 8 at 180°. To one of these pipe bends is connected a supply pipe 10, through which a flow of an air fluidized fibre material from a hammermill may be  
30 blown into the pipe system 6,8, wherein this flow may circulate.

As a result of the suction effect from the suction box 4 an air flow is conveyed down past and partially through the perforated pipes 6, whereby  
35 single fibres are discharged from these pipes; the fibres being sucked down for depositing on the forming wire 2. The pipes 6 are rotatably mounted, whereby

their perforations are cleaned for possible cloggings by the generally downwardly directed air flow to the suction box 4, just as they by their being rotated contribute to an increase of the discharge capacity for the fibres because of the associated centrifugal effect on the fibres which are at any moment present for discharging inside the perforations.

Inside each pipe 6 is mounted a quickly rotating needle cylinder 14 which is mounted in stationary bearings 16 on the pipe bends 8. The outer diameter of the needle cylinder 14 is considerably smaller than the diameter of the pipe 6, and the needle cylinder is placed such that its needles 18 sweep closely along the inside of the pipe 6 at a lower area thereof. The rotating needle cylinder brush will contribute to maintaining the fibre material flow through the pipe, with an outwardly directed centrifugal force which promotes the fibre discharge through the perforated pipe wall. When the needles 18 on the cylinder 14 are provided in a screw-formed row, an advantageous, axial conveyor effect on the fibre material will be obtained by the rotation of the cylinder.

According to the invention each of the pipes 6 is designed with an undulated cross-section, as it is seen from Fig. 2 and especially from Figs. 3 and 4. This cross sectional shape of the pipe 6 will have a pronounced reinforcing effect on the stability of the pipe in the transverse direction, i.e. the pipe can be self-supporting over a relatively large length, and moreover, the surface area of the pipe is substantially increased so that for a given degree of perforation it will have substantially more perforations than a simple circular cylindric pipe, and therewith an increased fibre discharge capacity. Because of the increased rigidity of the pipe it will even be possible to make use of an increased degree of perforation,

whereby the capacity is further increased.

To obtain the desired high capacity it is essential that a reorganization of the fibres takes place constantly by means of the needles 18. It is not fully clear how this actually takes place, but there is reason to believe that the essential effect lies in that the needles by their fast movement create a vacuum behind them, and that a turbulence is thus provided, this turbulence strongly affecting the fibres. As indicated in Fig. 4 this turbulence may propagate into the inner spaces of the undulation grooves which are open towards the interior of the pipe 6, i.e. a turbulence is created even in these spaces such that the fibres are reorganized immediately inside the perforations. The turbulence will be increased by the fact that the pressure condition will vary by the passage of the needle ends of the undulation tops and bottoms, respectively, and the capacity as a whole will therefore be increased considerably.

Moreover, according to this invention the needles on the cylinder 14 are preferably constituted by real carding needles, i.e. stiff, conical, pointed needles 18, which because of their pointedness prove especially well-suited for desintegration of both short and long fibres.

It will be appreciated that the tangential contact area between the pipe 6 and the brushes or needles 18 is of a great importance for the discharge capacity of the fibres, i.e. it is along this area that the discharge capacity is at its maximum. For the same reason it is essential to the smoothness of the cross profile of the fibre web which is laid out on the forming wire that the axial flow of air fluidized fibre material in the pipe 6 be particularly smooth and unhindered especially in or along this area. By the use of a non-undulated pipe wall this area is almost the only one along which the axial flow may not

6

flow unhinderedly, while it is obtained by the invention that in the said spaces outside the needle ends a further axial flowing possibility occurs, regardless of such flow having to pass through 5 turbulent air. The result is still that the axial flowing in the area concerned is improved, which contributes to both a good capacity and a good uniformity of the fibre discharge.

In Fig. 2 is shown but a single needle cylinder, 10 but it will be seen that there may optionally be room for more of such cylinders if this is desired.

In Fig. 4 are shown several different detailed embodiments of the corrugated profiling of the pipe 6; the invention is not limited to any particular 15 shape of the profiling.

The pipes 6 have been disclosed as rotating pipes, but relevant forming units exist, in which a stationary cylinder or a part-cylindrical housing of perforated sheet material cooperates with a needle 20 rotor filling out practically the entire cross section of the cylinder, and according to the invention even such a cylinder or housing may advantageously be shaped in a corrugated manner. The part-cylindrical housing is open along a top portion for receiving a 25 broad downward flow of fibre material, whereby such a screen housing does not perform axial conveying of the material. Thus, in a way, it is not a "pipe", but it will be appreciated that the arrangement according to the invention will be very advantageous anyway.



CLAIMS:

1. A distributor unit for dry laying out of fibres on a forming wire, mainly for dry manufacturing of paper, and of the type which comprises one or more perforated pipes which extend over the forming wire  
5 and are endwise connected to supply means for an air fluidized fibre material, each pipe preferably being rotatably mounted and cooperating with a rotating needle cylinder mounted stationarily inside the pipe,  
- characterized in that the perforated pipe is  
10 constituted by a shell or a cylinder consisting of a corrugated sheet material having its undulations extending in the longitudinal direction of the pipe.
2. A distributor unit according to claim 1,  
characterized in that the needles on the needle  
15 cylinder mounted in the pipe consist of stiff, pointed carding needles.

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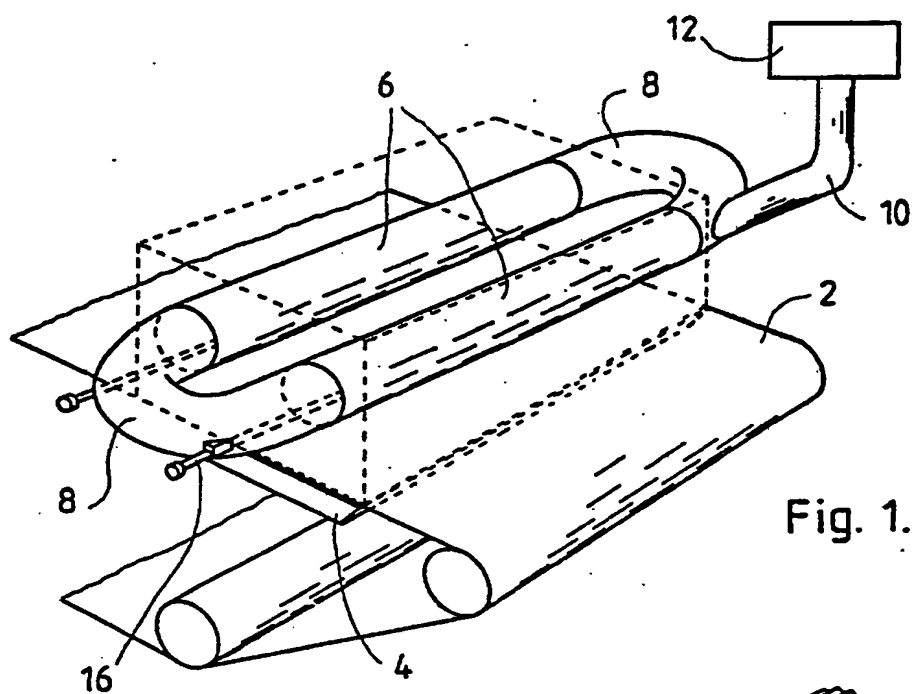


Fig. 1.

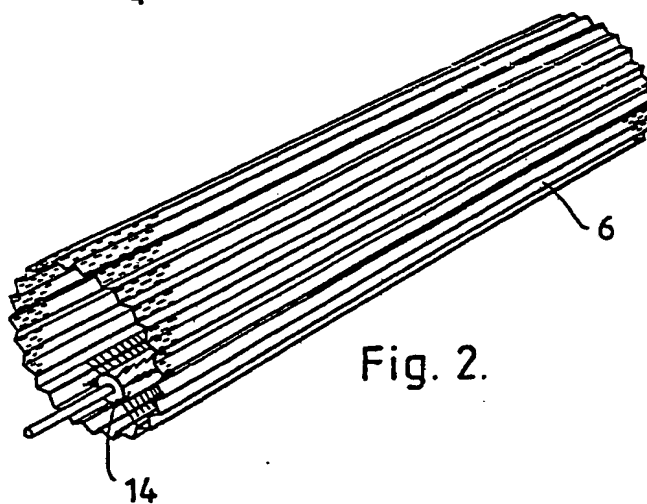


Fig. 2.

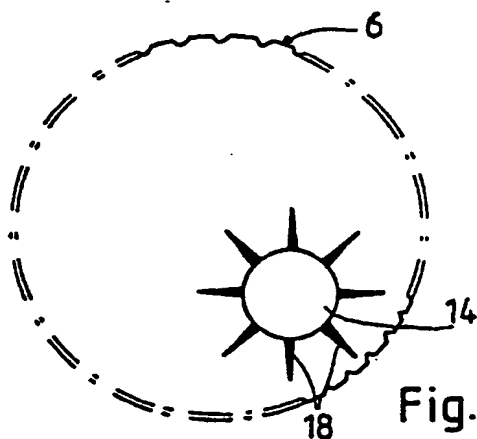


Fig. 3.

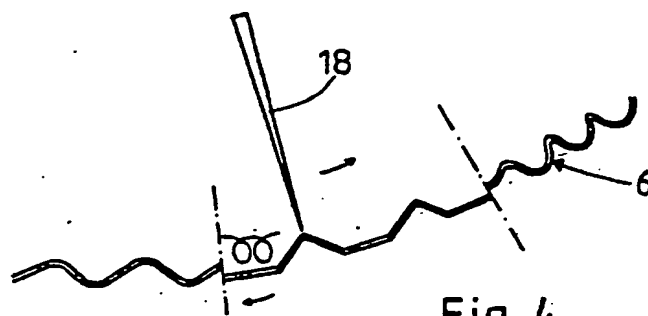


Fig. 4.

# INTERNATIONAL SEARCH REPORT

PCT/DK86/00096

International Application No

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) * According to International Patent Classification (IPC) or to both National Classification and IPC/4 <div style="text-align: center; font-weight: bold;">D 21 H 5/26</div>														
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; font-weight: bold;">Minimum Documentation Searched 7</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%;">Classification System</th> <th style="width: 75%;">Classification Symbols</th> </tr> <tr> <td style="vertical-align: top;">IPC US C1</td> <td style="vertical-align: top;">D 04 H 1/00-/04, /40, /70, /72; D 21 H 5/26 19:144, 145, 145.5, 145.7, 148, 155, 156, 156.1, 156.2, 156.3, 156.4, 296-308; 264:121; .../...</td> </tr> </table> <div style="text-align: center; font-weight: bold;">Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched *</div> <div style="padding: 10px; font-weight: bold;">SE, NO, DK, FI classes as above</div>			Classification System	Classification Symbols	IPC US C1	D 04 H 1/00-/04, /40, /70, /72; D 21 H 5/26 19:144, 145, 145.5, 145.7, 148, 155, 156, 156.1, 156.2, 156.3, 156.4, 296-308; 264:121; .../...								
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<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT *</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%;">Category *</th> <th style="width: 70%;">Citation of Document, 11 with indication, where appropriate, of the relevant passages 12</th> <th style="width: 20%;">Relevant to Claim No. 12</th> </tr> <tr> <td style="vertical-align: top;">X</td> <td style="vertical-align: top;">WO, A1, 81/02031 (SCAN-WEB I/S) 23 July 1981 &amp; US, 4352649 EP, 0032772 AU, 67749/81 AT, 4232 AU, 547989</td> <td style="vertical-align: top;">1-2</td> </tr> <tr> <td style="vertical-align: top;">X,P</td> <td style="vertical-align: top;">WO, A1, 86/00097 (SCAN-WEB I/S) 3 January 1986 &amp; EP, 0168957 AU, 44335/85 EP, 0188454</td> <td style="vertical-align: top;">1-2</td> </tr> <tr> <td style="vertical-align: top;">X,P</td> <td style="vertical-align: top;">EP, A1, 0 168 957 (SCAN-WEB OF NORTH AMERICA INC.) 22 January 1986 &amp; WO, 86/00097 AU, 44335/85 EP, 0188454</td> <td style="vertical-align: top;">1</td> </tr> </table>			Category *	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No. 12	X	WO, A1, 81/02031 (SCAN-WEB I/S) 23 July 1981 & US, 4352649 EP, 0032772 AU, 67749/81 AT, 4232 AU, 547989	1-2	X,P	WO, A1, 86/00097 (SCAN-WEB I/S) 3 January 1986 & EP, 0168957 AU, 44335/85 EP, 0188454	1-2	X,P	EP, A1, 0 168 957 (SCAN-WEB OF NORTH AMERICA INC.) 22 January 1986 & WO, 86/00097 AU, 44335/85 EP, 0188454	1
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<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p>* Special categories of cited documents: 10</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 48%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p> </div> </div>														
<b>IV. CERTIFICATION</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; vertical-align: top;">           Date of the Actual Completion of the International Search  <div style="text-align: center; font-weight: bold;">1986-11-11</div> </td> <td style="width: 50%; vertical-align: top;">           Date of Mailing of this International Search Report  <div style="text-align: center; font-weight: bold;">1986 -11- 18</div> </td> </tr> <tr> <td style="vertical-align: top;">           International Searching Authority  <div style="text-align: center; font-weight: bold;">Swedish Patent Office</div> </td> <td style="vertical-align: top;">           Signature of Authorized Officer  <div style="text-align: center;">               Barbro Nilsson           </div> </td> </tr> </table>			Date of the Actual Completion of the International Search <div style="text-align: center; font-weight: bold;">1986-11-11</div>	Date of Mailing of this International Search Report <div style="text-align: center; font-weight: bold;">1986 -11- 18</div>	International Searching Authority <div style="text-align: center; font-weight: bold;">Swedish Patent Office</div>	Signature of Authorized Officer <div style="text-align: center;">               Barbro Nilsson           </div>								
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## FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

II Fields Searched (cont):

US C1 425:80, 80.1, 81, 81.1, 82, 82.1,  
83, 83.1

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE <sup>1</sup>

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers ..... because they relate to subject matter not required to be searched by this Authority, namely:
  
2. ☐ Claim numbers ..... because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
  
3. ☐ Claim numbers ..... because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING <sup>2</sup>

This international Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:
3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:
4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the international Searching Authority did not invite payment of any additional fee.

## Remark on Protest

- ☐ The additional search fees were accompanied by applicant's protest.  
☐ No protest accompanied the payment of additional search fees.